



## An Evaluation of the Level I Natural Resources Inventory Process on Corps Operational Projects

*by Chester O. Martin and Jeffrey F. Krause*

**PURPOSE:** Engineer Regulation (ER) 1130-2-540 (U.S. Army Corps of Engineers (USACE) 2005) mandates that natural resource inventories be conducted on all Corps of Engineers (CE) operational projects. The basic inventory to be conducted at Corps projects was identified by the CE Stewardship Advisory Team (SAT) as the “Natural Resources Level I Inventory,” described in Krause et al. (2004). In 2005, a study was undertaken as part of the Ecosystem Management and Restoration Research Program (EMRRP) to (a) provide a basic protocol for conducting Level I inventories for Special Status Species, (b) evaluate broad-based inventory methods available for selected taxa, (c) field test and verify components of the Level I Inventory protocol, and (d) develop a methodology for assessing the condition of vegetation types on Corps lands. A protocol for conducting Level I Inventories was completed in 2005 and described in Martin et al. (2006). This technical note provides the results of a preliminary evaluation of the Level I protocol for selected Corps projects (Figure 1).



Figure 1. Level I Natural Resource Inventories were evaluated on selected Corps projects (photo courtesy of Daniel W. Hays, Kansas City District).

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**BACKGROUND:** Corps natural resources data are now tracked by the Corps Operations and Management Business Information Link (OMBIL) (USACE 2007a) and incorporated in the Environment-Stewardship Budget Evaluation System (E-S BEST) (USACE 2007b). Corps projects are required to enter natural resource inventory results into OMBIL, which can be used to automatically calculate performance measures.

Four data sets (vegetation, wetlands, soils, and Special Status Species) are recognized in ER 1130-2-540 as important basic components of natural resources management. The Level I Inventory is based on the following basic, nationally recognized information standards that are commonly utilized by other Federal and state agencies, and designation of Special Status Species as defined by the SAT:

- Project vegetation acreage classification and quantification, in accord with the Federal Geographic Data Committee (FGDC) *National Vegetation Classification System (NVCS)* (Grossman et al. 1998)
- Project wetland acreage classification and quantification, in accord with the U.S. Fish and Wildlife Service (USFWS) *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979)
- Project land (soils) capability classification and quantification, as defined by the Natural Resources Conservation Service (NRCS) – land capability classes
- Special Status Species (Federally listed threatened and endangered species and state-protected species) – potential occurrence on project lands, as described in Martin et al. (2006)

The SAT emphasized that Level I Inventories should be accomplished through GIS or other mapping procedures. Standard GIS programs should facilitate the delineation of major habitat types at the NVCS subclass level and make efficient use of existing electronic data sets for soils and wetlands. Although habitats or cover types may have been designated previously using other methods, acres should only be reported where the current data are mapped or described using the SAT approved data standard format (Krause et al. 2004). Additionally, acreages in each vegetative subclass present must be evaluated as sustainable (meeting desired state), transitioning (managed to meet desired state), degraded (does not meet desired goals), or not assessed. These natural resource condition measures are further described in Krause et al. (2004) and Martin et al. (2006).

**PROJECT TRACKING SYSTEM:** To facilitate evaluation of the Level I protocol, a project tracking system was developed to determine the ability of completing Level I inventories by project personnel. The following questions were asked regarding each basic component of the inventory process:

### **Vegetation**

1. Have vegetative types for your project been identified and classified in accordance with NVCS subclass categories?
2. What vegetative subclass types are present on your project?
3. What source did you use to identify vegetative subclasses?
4. Has each vegetative subclass been quantified? What method was used to tally acreage?
5. Can vegetative types be displayed using GIS?
6. Has each vegetative subclass been assigned a value as (a) sustainable, (b) transitioning, (c) degraded, or (d) not assessed?

7. If values were assigned, what method was used to determine these values?
8. What problems or special concerns did you have with applying the NVCS classification system to your project?

### **Soils**

1. Have project soils been classified into NRCS Land Capability Classes?
2. What source did you use to classify project soils?
3. Have soil types been quantified for your project?
4. Can soil types be displayed using GIS?
5. What problems did you have classifying and quantifying soil types?

### **Wetlands**

1. Have project wetlands been classified in accordance with the USFWS Cowardin system?
2. What wetland types exist on your projects?
3. Have wetland types been quantified by acreage and displayed using GIS?
4. What source of expertise did you use to identify wetland types?
5. What problems or concerns did you have with wetland classification?

### **Special Status Species**

1. Have you obtained a list of actual or potential Special Status Species for your project?
2. Are all Special Status Species available for your project through OMBIL lists?
3. What source of information or expertise did you use to identify potential Special Status Species for your project?
4. Have you identified habitat types on your project where each Special Status Species is expected to occur?
5. Has the occurrence of your Special Status Species been determined as (a) common, (b) occasional, (c) uncommon, (d) rare, or (f) absent? If so, how were these categories determined?
6. Do you have actual field survey data for any of the Special Status Species identified? If so, can their distribution be displayed on a project map?
7. What problems did you have identifying potential Special Status Species for your project?

**RESULTS OF THE PILOT STUDY:** Corps District and project personnel were informally requested to provide input to the project tracking questionnaire via contacts at SAT annual meetings and other activities (e.g., the Corps Prairie Workshop in Manhattan, Kansas, in August 2006). Responses were received from 27 projects representing five Districts. The Baltimore, Fort Worth, Kansas City, Philadelphia, and St. Louis Districts participated. Due to the preliminary nature of the findings, contact personnel and project locations will remain anonymous. The following paragraphs summarize results of the survey.

**Vegetation.** Only four of the 27 projects responded that vegetation types on the project had been classified in accordance with NVCS subclass categories. However, one District stated that a private contractor would assist them in completing vegetation subclass assessments at the remainder of their projects in FY07. One project identified the presence of five subclass types using aerial photos and ground truthing. Another project completed classification only to the class level. A District with a large number of projects identified the following subclasses for their projects: (a) nonvegetated; (b) annual graminoid or forb vegetation; (c) perennial graminoid vegetation (grasslands) (Figure 2);





Figure 2. "Perennial graminoid vegetation" was a common NVCS vegetation subclass on most projects in the Midwest (photo courtesy of Pamela Bailey, Environmental Laboratory, U.S. Army Engineer Research and Development Center (ERDC)).

(d) deciduous closed tree canopy; (e) deciduous open tree canopy; (f) mixed evergreen-deciduous open tree canopy; (g) mixed evergreen-deciduous shrubland; and (h) unconsolidated material-sparse vegetation.

Vegetative classes and subclasses were identified and quantified using aerial photos, GIS, historical records, and ground truthing. One project replied that subclasses were identified and the acreage was quantified using GIS calculation tools, and shapefiles were created for vegetation cover types.

Four projects reported that vegetative subclasses had been assigned a value. To accomplish this, one project stated that areas were initially analyzed from digital aerial imagery to provide a preliminary cover map; then ground truthing was conducted to assess accuracy (however, the exact method used was not explained). Another project reported that sub-classification and sustainability value determinations were in progress; again, the method used was not defined. Four projects from one District replied that visual observations and past documentation of vegetative condition were used to determine value.

The survey results were in agreement with summary OMBIL data for FY06. Corps-wide there are approximately 8 million fee-owned acres that may be classified as either non-vegetated or by the appropriate sub-class. A review of the 2006 performance measure results in OMBIL indicate that Corps-wide 2,516.185 acres, or 31 percent, of the fee land holdings of projects have been classified and entered into OMBIL. Only 2,000,516 acres have been assigned a condition, leaving nearly 6 million acres for which the Corps has not determined the health of the lands. The Level I inventory was incorporated as a performance measure for the 2007 budget process and significant funding was allotted during FY07 that should result in further completion of classification.

Participants expressed the following concerns regarding application of the NVCS classification system:

- It was difficult to manipulate imported data to fit only within the boundaries of Corps project lands.
- Project lands do not have a digitized project boundary.
- Existing map data were not available at the subclass level.
- There is a need to educate the project staff on vegetative types and procedures for mapping the types using aerial photography and GIS.
- There was too much subjectivity in determining the sustainable value.
- Further guidance was requested on assessing the condition of the vegetation subclasses.
- One project stated that the link to NVCS provided in the initial guidance did not take them to the NVCS classification system, but rather took them to a site where they could register to become a member.

**Soils.** Of the 27 projects, 25 responded that project soils had been classified into NRCS Land Capability Classes. Sources used to classify soils included NRCS SURGO digital soil data and the NRCS Soils Data Mart – online GIS system. Most projects reported that soils had been quantified by acreage and class and could be displayed using GIS. Soils at one project could only be displayed online and there were no on-site data. At another site, only the county Soil Survey could be used to display soil data.

Participants noted the following problems for classifying and quantifying soil types:

- It was difficult to manipulate soil data to fit within Corps project boundaries.
- One District replied that the biggest problem was overlaying the project boundary on digital soil maps and calculating acreages of individual soil classes.
- Some states did not have access to electronic soil coverage.
- It was difficult to translate soil types into land capability classes.
- In order to apply the NRCS Land Capability Classification system, it must be related to county soil surveys, but there is no clear relation. The soils geospatial data must then be clipped and joined in GIS to determine quantity.

The 2006 performance measure results found in OMBIL indicate that Corps-wide, 1,209,185 acres (29 percent) of the terrestrial land holdings of projects have been classified according to soil capability and entered into OMBIL.

**Wetlands.** All 27 projects reported that their project wetlands had been classified in accordance with the USFWS Cowardin system (Figure 3). A variety of wetland types were identified on Corps lands. One project listed 24 wetland types; another District reported nine types. Most projects have quantified wetland types and are able to display them using GIS. One project responded that wetland acreage had been quantified, but the project does not have GIS capability; data were collected using the FWS wetland mapper. Sources of expertise were primarily National Wetland Inventory (NWI) data and digital maps; one project reported personal expertise.





Figure 3. All projects surveyed classified their wetlands in accordance with the USFWS Cowardin system (photo courtesy of Chester O. Martin, Environmental Laboratory, ERDC).

Problems or concerns with wetland classification were as follows:

- The NWI inventory is incomplete, and site-by-site delineation is necessary to identify and quantify any additional wetlands.
- The USFWS NWI does not include recently constructed wetlands.
- Trained personnel are not available on the project to complete classification beyond the NWI level.
- Some projects have not had the time or resources to map wetlands in GIS.
- Electronic data from the USFWS included fields with abbreviations and were difficult to match when making a query for acreages of wetland types.
- Two projects could download the wetland data from the USFWS but did not have digital boundaries to clip over and retrieve data.

A review of the 2006 performance measures indicate that to date 1,182,000 acres of wetlands have been classified on project lands.

**Special Status Species.** Most projects responded that they had obtained a list of actual or potential Special Status Species occurring on their projects. One District reported that a list had been obtained for all of their projects. Most projects also stated that a list of species was available through OMBIL. However, one District replied that many of their Special Status Species were not available

through OMBIL, and that they have had to add numerous species. There were also a number of species in the OMBIL listings that are not Special Status Species. Sources of information or expertise used to identify potential Special Status Species included state and USFWS county lists, state and USFWS information supplied on websites, updated master plans for endangered and threatened species, and field surveys for selected species.

Nineteen projects replied that habitat types had been identified where Special Status Species were expected to occur; another stated that this task was in progress. Identifying Special Status Species as common, occasional, uncommon, rare, or absent appeared to be somewhat subjective in most cases. Several projects were able to use incidental information provided by project personnel and others, such as the National Audubon Society. Some projects reported field surveys and distributional mapping for selected species. Field survey data were available mostly for high profile species such as the bald eagle (*Haliaeetus leucocephalus*) (Figure 4) and the gray bat (*Myotis grisescens*). One District replied that determinations were based on historic knowledge provided by long-term project staff and informal surveys. One project reported that bald eagle and osprey (*Pandion haliaetus*) distribution could be displayed in GIS.

The following problems were identified in regard to identifying potential Special Status Species:

- Determining species occurrence and abundance was subjective.
- Projects lacked time and resources to interview sources of regional expertise.
- Staff resources are not available to complete inventories.
- In one case, funds designated for inventories were diverted to cover insufficient funding in the recreation business line.
- One District reported that there were no problems identifying potential Special Status Species because this had already been done when preparing project Operational Management Plans (OMPs).
- A few projects felt that the definition of potential species needs to be clarified because some projects were including any species occurring in the region.
- The OMBIL database only separates species by Federal and State designations and does not provide a breakdown of the specific status of species, such as Federally threatened or Federally endangered.



Figure 4. Several projects reported that field survey data were available for high profile Special Status Species such as the bald eagle (photo courtesy of Michael A. Watkins, Kansas City District).

A review of the national OMBIL dataset shows over 1,169 occurrences of 216 different Federal species at operational projects. The presence of a Federal species with Biological Opinion



requirements was indicated at 105 projects. This illustrates the importance of ensuring a complete and consistent protocol that can be improved through addressing the concerns expressed in the surveys conducted.

**DISCUSSION:** This technical note represents a preliminary assessment of District and project progress in conducting Natural Resource Level I inventories on their lands. Although the sample size was small (27 projects), results of the survey suggested obvious trends in the four components examined. Although few projects had completed identification and classification of vegetative subclasses in accordance with NVCS standards, most projects had at least initiated the effort and planned to complete the surveys within the near future. Due to the establishment of the Level I inventory performance measure for the 2007 budget process, implementation is expected to increase. Subclasses were identified and quantified using a combination of photos, GIS, historical records, field surveys, and ground truthing. Primary concerns included the absence of existing map data at the subclass level, difficulty in fitting existing data within project boundaries, and the need to educate project personnel on the mapping and GIS process.

Although not expressed in responses to the survey, additional concerns regarding NVCS classification must be addressed in order to standardize and complete Level I Inventories. As discussed in Martin et al. (2006), consistency is required among Districts and projects when assigning condition ratings (sustainable, transitioning, or degraded) for each vegetative subclass. ERDC's Environmental Laboratory and the SAT are presently interacting with NatureServe to develop a rapid assessment methodology that can be used throughout the Corps. Additionally, the existing NVCS system is presently undergoing revision (Federal Geographic Data Committee (FGDC) 2006), which could cause future problems with Corps OMBIL data. Therefore, NatureServe will develop the Corps condition assessment protocol so that it can be cross-walked between the two systems. This would allow for inputting the present OMBIL requirements and making adjustments at a later date if needed.

Most of the responding projects stated that their soils had been classified into NRCS Land Capability Classes using NRCS digital soils data and the NRCS online GIS system. The major problem expressed was the inability to overlay project boundaries on digital soil maps and inability to calculate exact acreages of individual soil classes. Electronic coverage was not available for some projects, and some had difficulty associating soil types with land capability classes. Similarly, most projects were successful in identifying and mapping their wetlands using the USFWS Cowardin system, and most projects were able to display project wetlands using GIS. Concerns included the need to train personnel to conduct wetland inventories at the site level and certain limitations of the USFWS NWI inventory.

Although most projects reported that they had obtained a list of potential Special Status Species for their projects, several projects voiced concern regarding the completeness and accuracy of species currently provided in OMBIL. Through the development of this technical note, these issues have been recognized by the SAT, and a committee is currently making progress on making corrections to the existing list. Nineteen projects, most of which were represented by one District, reported that they had identified habitat types where Special Status Species were expected to occur. This is likely the case for high profile species, especially federally listed species, but may not be the case for many state-listed plants and animals. Determining species occurrence was highly variable and appeared to

be subjective in many cases. Project personnel may not be available or qualified to make determinations regarding Special Status Species, and funds are often not available to conduct surveys by contract.

**CONCLUSIONS:** A preliminary evaluation of the Corps of Engineers Level I Inventory protocol was conducted in 2006 and 2007. This was performed by developing a project tracking system used to evaluate progress in completing the inventory on a sample of 27 projects representing five Districts. Few projects in the sample completed identification and classification of vegetative subclasses, but most projects have initiated the surveys. There appeared to be considerable variability and subjectivity in making vegetation condition assessments and further guidance on land condition assessment through an additional technical note or information bulletin was determined to be the highest priority for future funding. Preliminary steps to develop such protocol have been initiated with NatureServe. Most projects have classified their soils using NRCS digital soils data and the NRCS online GIS system, and most projects have mapped their wetlands using the USFWS Cowardin system. However, there were some limitations to the USFWS NWI database. Most projects have obtained a preliminary list of Special Status Species, but habitats have generally been mapped only for high profile species. The SAT is currently working to revise and improve the existing OMBIL list of Special Status Species.

Based on the results of this pilot study, the following actions are recommended to facilitate Level I Inventories throughout the Corps:

- Training is needed for several aspects of the Level I Inventory, particularly the NVCS classification system.
- Greater coordination is required for developing project lists of appropriate Special Status Species. This should include Corps, USFWS, and state personnel.
- Regional workshops should be conducted to explain the entire Level I Inventory protocol for Natural Resource managers and rangers.
- Districts need to establish Level I Inventories as a priority and ensure that funding is available to train personnel and complete the process.
- Few projects have assessed conditions for the vegetation inventory. An additional follow-up publication specifically designed to provide guidance on assessing conditions is needed and is considered a high research priority by the SAT.

Continued improvements and completion of the Level I inventory will provide a database of important ecological elements, their condition, and their relationship to Special Status Species. The long-term benefits of the completed inventory will provide important baseline information and annual tracking of performance-based results that will assist in setting budget, research, and policy guidance.

**POINTS OF CONTACT:** For additional information, contact Mr. Chester O. Martin (601-634-3958, [Chester.O.Martin@erdc.usace.army.mil](mailto:Chester.O.Martin@erdc.usace.army.mil)), Mr. Jeffrey Krause (814-658-6813, [Jeff.Krause@usace.army.mil](mailto:Jeff.Krause@usace.army.mil)), or the Program Manager of the Ecosystem Management and Restoration Research Program, Mr. Glenn Rhett (601-634-3717, [Glenn.G.Rhett@erdc.usace.army.mil](mailto:Glenn.G.Rhett@erdc.usace.army.mil)). This technical note should be cited as follows:

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